Simplified Models for Snowmass 2013 Status Update

Timothy Cohen
with Kiel Howe and Jay Wacker
(SLAC/Stanford)

Snowmass 2013 Energy Frontier Bi-weekly Meeting
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Why Simplified Models?

- One major focus of the Snowmass process is to access the physics potential of a variety of machines.

- Simplified models are signature driven.
  - Include a tractable number of parameters.
  - Probe difficult regions of phase space.
  - Provide a framework for making “apples to apples” comparisons between machines.

Which Simplified Models?

- The SLAC group [TC, Kiel Howe, Jay Wacker] are planning to generate the models where the parent states are produced hadronically.
- Particles we plan to consider (in many combinations):
  - gluino,
  - bino-like LSP,
  - light flavored squarks,
  - heavy flavored squarks,
  - NLSP neutralino/chargino in cascade decays.

http://www.stanford.edu/~timcohen/SimplifiedModelsForSnowmass.pdf

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- We are *not* planning to generate:
  - electroweak production of neutralinos/charginos,
  - models with gravitino LSPs,
  - models with light sleptons.

How?

- Events generation:
  - MadGraph5 + Pythia: matched up to 2 jets.
  - We developed a weighting procedure to target compressed spectra.

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- Detector simulation:
  - Delphes3.
  - We have not included pileup.
- Cross sections:
  - NLO cross sections using Prospino v2.1.
  - We have to modify Prospino to get 33 TeV and 100 TeV results.

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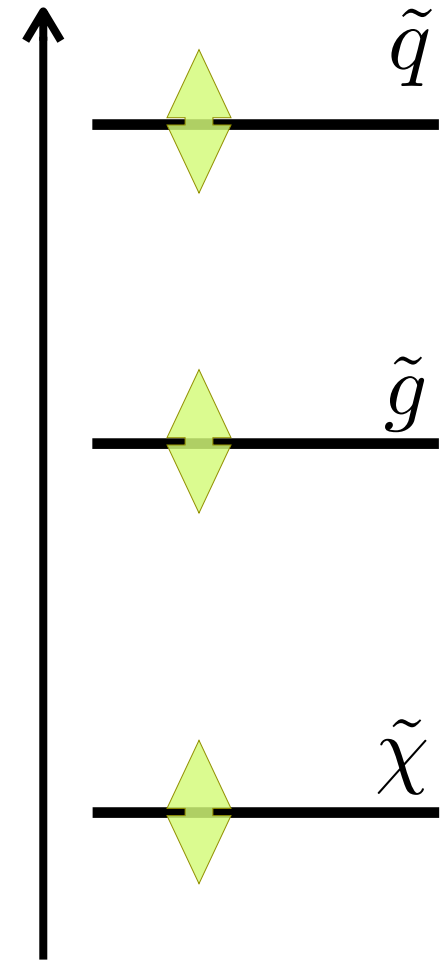
We will use Prospino until we hear otherwise.

Where do we start?

Gluino-neutralino simplified model

MASS

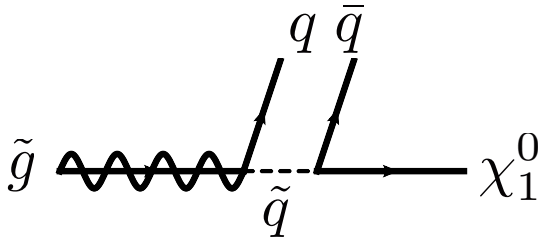


color fundamental scalar ("Squark")

color octet Majorana fermion ("Gluino")

neutral Majorana fermion ("LSP")

Three body decay



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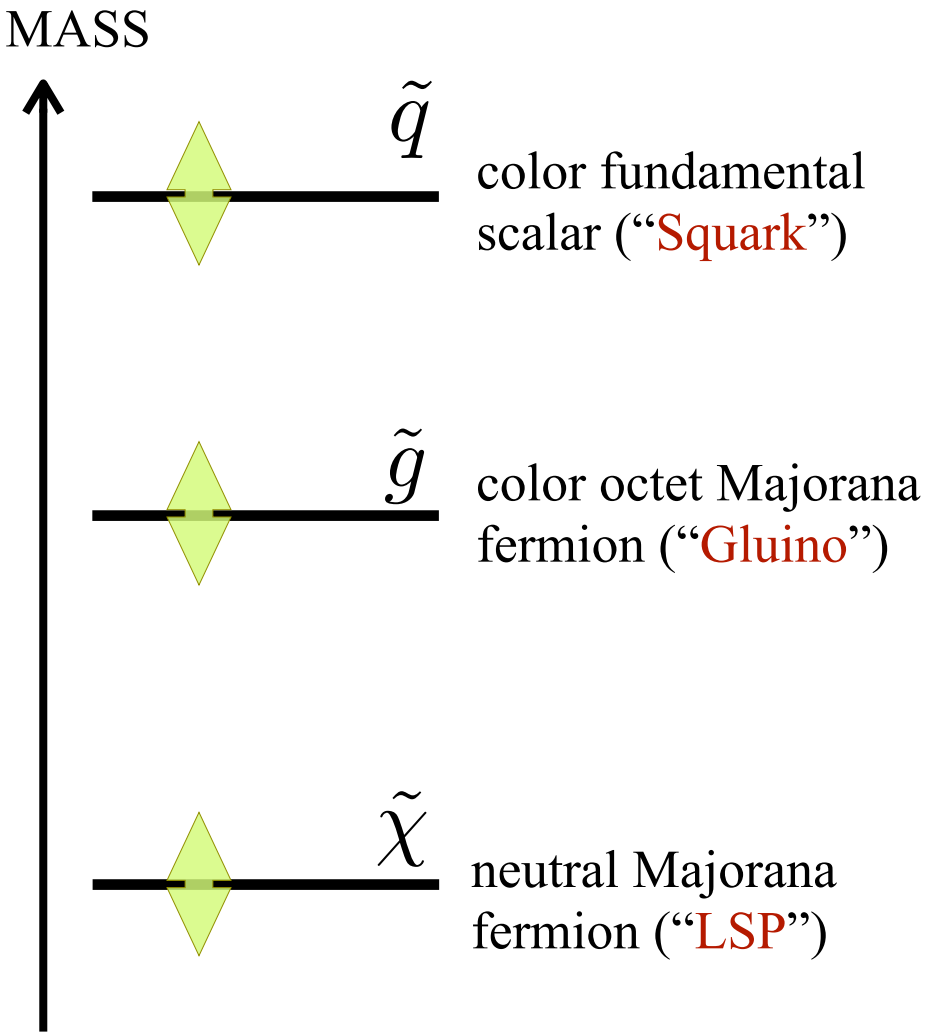
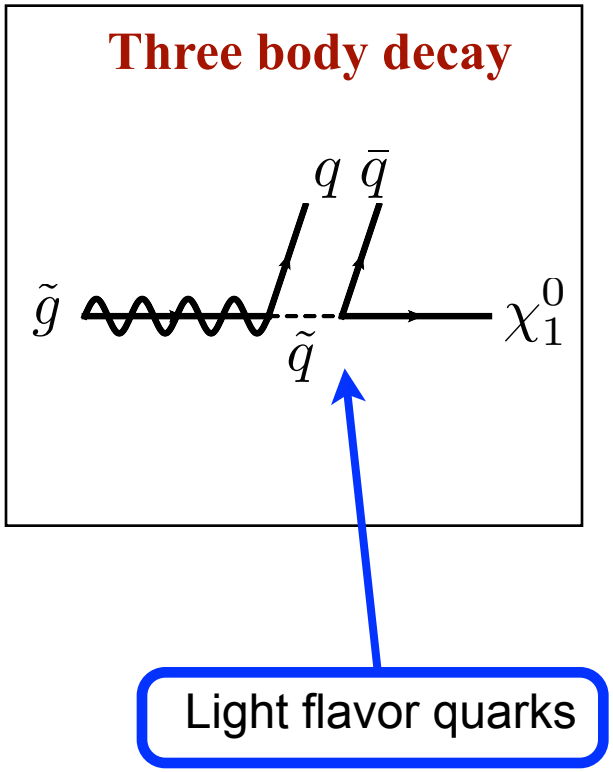
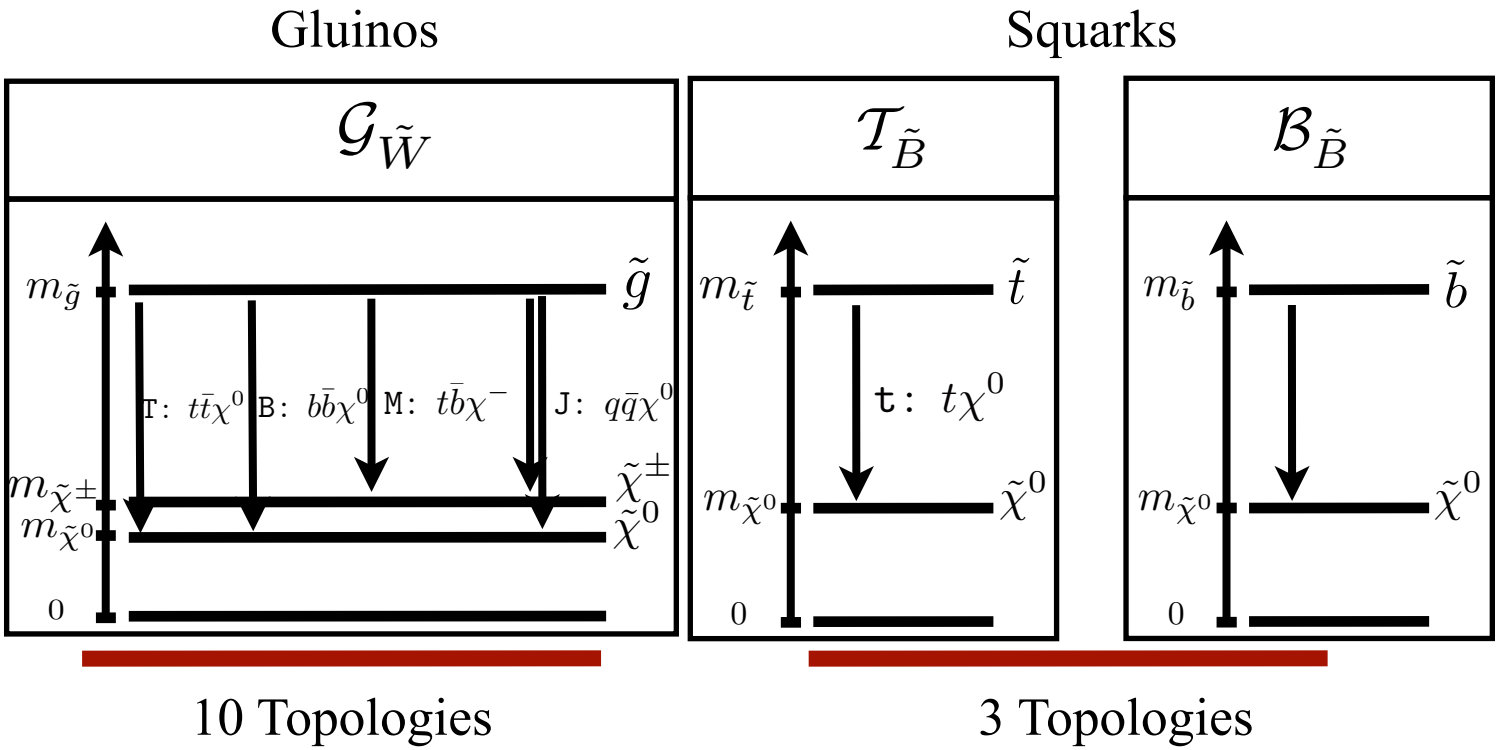




What comes next?

- Simplified model for “natural SUSY.”

Essig, Izaguirre, Kaplan, Wacker [arXiv:1110.6443]



10 Topologies

3 Topologies

3 Free Parameters in Each Topology

2 Masses & Cross Section x BR

Status

- We have generated paper!
  - A concrete proposal for which simplified models we plan to generate with the detailed parameter grids, etc. can be found here:
    http://www.stanford.edu/~timcohen/SimplifiedModelsForSnowmass.pdf
  - A detailed description of our algorithm for generating weighted events (including an example to justify the procedure) can be found here: http://www.stanford.edu/~timcohen/WeightedEventsUsingMadgraph.pdf

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- We have generated events!
  - The full gluino-neutralino mass grid.
  - Utilizes our weighting procedure.
    https://www.dropbox.com/s/bntz81jowvevv06/GO_decoupledSQ_13TeV.tar.gz
  - Mike Hance (LBNL) and his colleagues are ready to make limit plots; they just need Delphes3 backgrounds.